

REMARKS

The present Amendment amends claims 1, 3-5, 7-14, 19 and 20, and leaves claims 2 and 6 unchanged. Therefore, the present application has pending claims 1-14, 19 and 20.

35 U.S.C. §103 Rejections

Claims 1, 3, 4, 8, 9, 11-13, 19 and 20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U. S. Patent Publication No. 2003/0009640 to Arimilli et al. ("Arimilli") in view of U. S. Patent No. 7,139,890 to Moran et al. ("Moran"). This rejection is traversed for the following reasons. Applicants submit that the features of the present invention, as now more clearly recited in claims 1, 3, 4, 8, 9, 11-13, 19 and 20, are not taught or suggested by Arimilli or Moran, whether taken individually or in combination with each other in the manner suggested by the Examiner. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

Amendments were made to the claims to more clearly describe features of the present invention. Specifically, amendments were made to the claims to more clearly recite that the present invention is directed to a cache control method, a relay device, a storage device, and a computer-readable medium as recited, for example, in independent claims 1, 3, 11 and 19.

The present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, provides a cache control method in a computer system that includes a storage device having a plurality of physical devices for storing data, at least one client, and a relay device, The cache control method includes relaying, by the relay device, data between the storage device and

each of the at least one client, where the relay device includes a cache disk module for caching processed data being relayed between the storage device and the at least one client. The cache control method also includes relating data processed in the computer system with attribute data which configures a caching operation of the cache disk module that caches the processed data on a primary network which connects each of the at least one client and the relay device to each other. The cache control method further includes mediating the processed data between the storage device and each of the at least one client via a secondary network, which connects the relay device and the storage device to each other, without the caching operation of the cache disk module when the attribute data prohibits the caching operation.

According to the present invention, a plurality of virtual volumes are formed on the physical devices, and each of the at least one client is assigned to at least one of the virtual volumes, thereby permitting the each of the at least one client to access data stored in the at least one of the virtual volumes to which it is assigned.

Also according to the present invention, the attribute data is held in a cache attribute management table which stores a plurality of entries each of which sets a corresponding relation between identification information identifying one of the virtual volumes, identification information identifying one of the physical devices forming a part of the one of the virtual volumes and an indication whether data stored in the one of the physical devices is cacheable or not.

Furthermore, according to the present invention, each entry of the cache attribute management table further sets a corresponding relation

between an indication as to whether data to be read from a physical device forming part of the one of the virtual volumes is cacheable or not and an indication as to whether data to be written to the physical device forming part of the one of the virtual volumes is cacheable or not. The prior art does not teach or suggest all of these features.

The above described features of the present invention, as now more clearly recited in the claims, are not taught or suggested by any of the references of record. Specifically, the features are not taught or suggested by either Arimilli or Moran, whether taken individually or in combination with each other.

Arimilli teaches a non-uniform memory access (NUMA) data processing system having a page table including node-specific data storage and coherency control. However, there is no teaching or suggestion in Arimilli of the cache control method, the relay device, the storage device, or the computer-readable medium as recited in claims 1, 3, 11 and 19 of the present invention.

Arimilli discloses where a non-uniform memory access (NUMA) data processing system includes a plurality of nodes coupled to a node interconnect. The plurality of nodes contains a plurality of processing units and at least one system memory having a table (e.g., a page table) resident therein. The table includes at least one entry for translating a group of non-physical addresses to physical addresses that individually specifies control information pertaining to the group of non-physical addresses for each of the plurality of nodes. The control information may include one or more data storage control fields, which may include a plurality of write through indicators

that are each associated with a respective one of the plurality of nodes.

When a write through indicator is set, processing units in the associated node write modified data back to system memory in a home node rather than caching the data. The control information may further include a data storage control field comprising a plurality of non-cacheable indicators that are each associated with a respective one of the plurality of nodes. When a non-cacheable indicator is set, processing units in the associated node are instructed to not cache data associated with non-physical addresses within the group translated by reference to the table entry. The control information may also include coherency control information that individually indicates for each node whether or not inter-node coherency for data associated with the table entry will be maintained with software support.

One feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes relaying, by the relay device, data between the storage device and each of the at least one client. Arimilli does not disclose this feature.

For example, Arimilli does not teach or suggest where the relay device relays data between the storage device and *each* at least on client. With reference to Fig. 1, the Examiner asserts that the switch 15 corresponds to the relay device of the present invention, that the nodes 12 correspond to the at least one client of the present invention, and that the memory controllers 14 correspond to the storage device including a cache of the present invention. However, based upon the Examiner's interpretation of Fig. 1, the relay device (switch 15) does not relay data between the storage device (memory controller 14) and *each* client (node 12), in the manner claimed. More

specifically, with reference to the uppermost client (node 12) depicted with a dashed box, where the uppermost client includes the storage device (memory device 14), the relay device (switch 15) does not relay data between the uppermost client (node 12 shown with the dashed box) and the uppermost client's own storage device (memory controller 14). In this way, Arimilli does not teach where the relay device relays data between *each* client (i.e., including the uppermost client with the dashed box) and the storage device (memory controller 14).

Another feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes where the relay device includes a cache disk module for caching processed data being relayed between the storage device and the at least one client. Arimilli does not disclose this feature, and the Examiner does not rely upon Arimilli for teaching this feature.

Yet another feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes relating data processed in the computer system with attribute data which configures a caching operation of the cache disk module that caches the processed data on a primary network which connects each of the at least one client and the relay device to each other. Arimilli does not disclose this feature.

For example, Arimilli does not teach or suggest where a primary network connects *each* of the at least one client and the relay device to each other, in the manner claimed. With reference to Fig. 1, the Examiner asserts that the node 12 to switch 15 network of Arimilli corresponds to the primary network of the present invention. However, in the present invention, the

primary network connects *each* client and the relay device to each other, whereas, according to the Examiner's interpretation of Fig. 1, Arimilli's primary network does not connect *each* client and the relay device to each other. More specifically, the uppermost client depicted with the dashed box is not included in the primary network, based on the Examiner's interpretation. Accordingly, Arimilli does not disclose where the primary network connects *each* client and the relay device to each other, as in the present invention.

Still yet another feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes mediating the processed data between the storage device and each of the at least one client via a secondary network, which connects the relay device and the storage device to each other, without the caching operation of the cache disk module when the attribute data prohibits the caching operation. Arimilli does not disclose this feature.

For example, Arimilli does not teach or suggest mediating the processed data between the storage device and *each* client via a secondary network, which connects the relay device and the storage device to each other, as in the present invention. With reference to Fig. 1, the Examiner asserts that the secondary network includes the network between the uppermost client (node 12 depicted by the dashed box) and the relay (switch 15). As previously discussed, the Examiner asserts that the memory controller 14 corresponds to the storage device of the present invention. In view of the Examiner's interpretation, Arimilli does not teach where the processed data is mediated between the storage device (memory controller 14) and *each* client (the uppermost node 12 enclosed by the dashed box), as

this would require that data of the storage device is mediated to itself via the relay, and this does not occur in Arimilli. Furthermore, the processed data of Arimilli is mediated to *each* of the *other* clients (lowermost nodes 12) via the primary network, which is different from the secondary network. Therefore, Arimilli does not teach where the processed data is mediated between the storage device and *each* client, in the manner claimed.

Therefore, Arimilli fails to teach or suggest “relaying, by said relay device, data between said storage device and each of said at least one client” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

Furthermore, Arimilli fails to teach or suggest “wherein said relay device includes a cache disk module for caching processed data being relayed between said storage device and said at least one client” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

Further, Arimilli fails to teach or suggest “relating data processed in the computer system with attribute data which configures a caching operation of the cache disk module that caches the processed data on a primary network which connects each of said at least one client and said relay device to each other” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

Even further, Arimilli fails to teach or suggest “mediating the processed data between the storage device and each of the at least one client via a secondary network, which connects said relay device and said storage device to each other, without the caching operation of the cache disk module when the attribute data prohibits the caching operation” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

The above noted deficiencies of Arimilli are not supplied by any of the other references of record, namely Moran, whether taken individually or in combination with each other. Therefore, combining the teachings of Arimilli and Moran in the manner suggested by the Examiner still fails to teach or suggest the features of the present invention as now more clearly recited in the claims.

Moran teaches methods and arrangements to interface memory. However, there is no teaching or suggestion in Moran of the cache control method, the relay device, the storage device, or the computer-readable medium as recited in claims 1, 3, 11 and 19 of the present invention.

Moran discloses methods and arrangements to interface memory. Disclosed embodiments include comparing a transaction or access from a source to memory addresses associated with the source to determine whether an address associated with the transaction is accessible by the source. Some embodiments may include defining protected memory. Several embodiments may include defining protected memory by, for example, determining a configuration for memory. Such embodiments may include protecting a memory location or limiting access to memory addresses associated with a protected memory location. Some of these embodiments may include accessing registers to define protected memory and verifying accesses to a memory location according to the definition of protected memory. Further embodiments may include generating an association between a source of an access and a memory location and storing the association to facilitate access to the memory location by the source.

One feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes relaying, by the relay device, data between the storage device and each of the at least one client. Moran does not disclose this feature, and the Examiner does not rely upon Moran for teaching this feature.

Another feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes where the relay device includes a cache disk module for caching processed data being relayed between the storage device and the at least one client. Moran does not disclose this feature.

To support the assertion that Moran teaches this feature, the Examiner cites Fig. 1, item 130. However, neither the cited figure, nor any other portion of Moran teaches the claimed feature.

For example, Moran does not teach or suggest where a relay device includes a cache disk module. Specifically, Moran's configuration memory 130 is not the same as a cache disk module for caching processed data as in the present invention.

By way of further example, and contrary to the Examiner's assertions, it would not be obvious to modify the teachings of Arimilli to include the configuration memory 130 in the relay of Arimilli. As described in MPEP 2143.01(VI), the proposed modification cannot change the principle of operation of a reference. If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ

349 (CCPA 1959) (Claims were directed to an oil seal comprising a bore engaging portion with outwardly biased resilient spring fingers inserted in a resilient sealing member. The primary reference relied upon in a rejection based on a combination of references disclosed an oil seal wherein the bore engaging portion was reinforced by a cylindrical sheet metal casing. Patentee taught the device required rigidity for operation, whereas the claimed invention required resiliency. The court reversed the rejection holding the "suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [the primary reference] as well as a change in the basic principle under which the [primary reference] construction was designed to operate." 270 F.2d at 813, 123 USPQ at 352.).

Arimilli teaches the use of a switch 15 and a cache 22. According to the Examiner, the cache 22 of Arimilli functions to store data, as in the present invention. The cache 22 of Arimilli, which is not in the switch 15, allegedly serves the purpose of the cache disk module of the present invention. Accordingly, it would not be obvious to further modify the switch 15 of Arimilli to include the configuration memory 130 of Moran. Furthermore, even if the switch 15 of Arimilli were modified to include the configuration memory 130 of Moran, the modified switch including a the configuration memory is not the same as a relay including a cache disk module, as in the present invention.

Yet another feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes relating data processed in the computer system with attribute data which configures a caching operation of the cache disk module that caches the processed data on a primary network which connects each of the at least one client and the relay device to

each other. Moran does not disclose this feature, and the Examiner does not rely upon Moran for teaching this feature.

Still yet another feature of the present invention, as recited in claim 1, and as similarly recited in claims 3, 11 and 19, includes mediating the processed data between the storage device and each of the at least one client via a secondary network, which connects the relay device and the storage device to each other, without the caching operation of the cache disk module when the attribute data prohibits the caching operation. Moran does not disclose this feature, and the Examiner does not rely upon Moran for teaching this feature.

Therefore, Moran fails to teach or suggest “relaying, by said relay device, data between said storage device and each of said at least one client” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

Furthermore, Moran fails to teach or suggest “wherein said relay device includes a cache disk module for caching processed data being relayed between said storage device and said at least one client” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

Further, Moran fails to teach or suggest “relating data processed in the computer system with attribute data which configures a caching operation of the cache disk module that caches the processed data on a primary network which connects each of said at least one client and said relay device to each other” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

Even further, Moran fails to teach or suggest “mediating the processed data between the storage device and each of the at least one client via a secondary network, which connects said relay device and said storage device

to each other, without the caching operation of the cache disk module when the attribute data prohibits the caching operation” as recited in claim 1, and as similarly recited in claims 3, 11 and 19.

Both Arimilli and Moran suffer from the same deficiencies, relative to the features of the present invention, as recited in the claims. Therefore, combining the teachings of Arimilli and Moran in the manner suggested by the Examiner does not render obvious the features of the present invention as now more clearly recited in the claims. Accordingly, reconsideration and withdrawal of the 35 U.S.C. §103(a) rejection of claims 1, 3, 4, 8, 9, 11-13, 19 and 20 as being unpatentable over Arimilli in view of Moran are respectfully requested.

Claims 2, 5-7 and 14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Arimilli in view of Moran, and further in view of U. S. Patent Application Publication No. 2002/0144119 to Benantar. Claim 2 is dependent on claim 1, claims 5-7 are dependent on claim 3, and claim 14 is dependent on claim 11. Therefore, claims 2, 5-7 and 14 are allowable for at least the same reasons previously discussed regarding their respective independent claims.

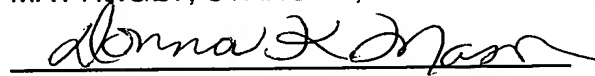
Claim 10 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Arimilli in view of Moran, and further in view of U. S. Patent No. 5,737,522 to Matsumoto. Claim 10 is dependent on claim 3. Therefore, claim 10 is allowable for at least the same reasons previously discussed regarding independent claim 3.

The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references used in the rejection of claims 1-14 and 20.

In view of the foregoing amendments and remarks, Applicants submit that claims 1-14 and 20 are in condition for allowance. Accordingly, early allowance of claims 1-14 and 20 is respectfully requested.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C., Deposit Account No. 50-1417 (Referencing Attorney Docket No. 1288.43131X00).

Respectfully submitted,
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